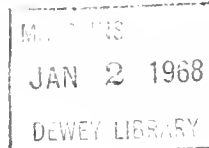






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The Cost Effectiveness of the Solicitation
Process For Research and Development Proposals

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November 1967

#297-67

This report is based on a doctoral thesis completed in 1967. The author acknowledges the help of his committee, P.O. Soelberg and D.G. Marquis. The work was supported in part by a grant from NASA.

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ABSTRACT

A study of the decision to bid in 48 companies competing in 2 government R&D competitions, and of the proposal preparation process of 21 companies in 6 competitions was made. Evaluations of each of the 21 proposals were obtained from the relevant government agencies and used as criteria of effectiveness. Widespread ignorance of the market by the companies was discovered. Several pricing and costing strategies were identified and their effectiveness evaluated. A detailed model of the decision to bid and the pricing decision was built. It is suggested that increased feedback from government to all companies about their relative performance at the conclusion of each competition would improve the efficiency of competitive procurements.

THE COST EFFECTIVENESS OF THE SOLICITATION PROCESS FOR RESEARCH AND DEVELOPMENT PROPOSALS

Introduction

- How can the cost effectiveness of the proposal solicitation process for government research and development procurements be assessed?
- Do all of the best qualified companies submit bids on each competition?
- Is true competitive behavior typical of companies in the preparation of their proposals?

These questions will be explored in this analysis of the proposal solicitation process. We are here distinguishing the proposal solicitation process from the contract performance phase of the total procurement cycle. The proposal solicitation process consists of only the elicitation from companies of a decision to submit a proposal and the actual preparation of that proposal. A cost effectiveness analysis of this phase of the procurement process is important because the government ultimately pays for a major portion of all proposal efforts, regardless of whether they are successful or unsuccessful. Allen (1964) found in small procurements with many proposers that the cost of all proposal preparations often equals the dollar value of the contract to be let. While in larger contracts this relationship may not persist, the absolute magnitude of such expenditures is large enough to constitute a sum worth saving.

In the past the principal effectiveness criteria for studies of the R&D procurement process have been measures of the quality of the winning company's performance in the execution of the contract. Primarily these measures were of the discrepancies between estimated and actual cost, completion time, and performance. These are important dimensions of the

efficiency of any government procurement activity. However, other criteria may be more revealing for the solicitation process. One approach to the discovery of new criteria is to examine internally companies' bid decisions and the decisions which they make in the preparation of their proposals.

Some Important Questions of Cost Effectiveness

In any analysis of cost effectiveness the relevant trade-offs and the factors which affect these trade-offs must be identified. In this discussion the critical aspects of these relationships will be explored through a set of questions. With regard to cost effectiveness in the bid decision one might make these inquiries:

- To what extent do present solicitation procedures elicit proposals from highly qualified companies and discourage proposals from less qualified companies?
- Why do some highly qualified companies not bid?
- Why do some poorly qualified companies decide to submit bids?
- Are company bid decisions based on accurate perceptions of the competition, of the customer, and of the contract requirements, or are they based on poor information, misconceptions of the market, and erroneous internally generated biases?
- Are companies able to accurately assess the quality of their technical approaches prior to making their bid decisions?

If companies are unable to assess the technical quality of their proposals or have an incorrect or incomplete model of the market, they will be unable to make effective bid decisions. They will expend proposal funds with little chance of success. The government is a double loser in

this situation because it receives less than the best set of technical proposals and must also ultimately absorb the proposal preparation costs.

In the proposal preparation phase the following questions might be asked:

- Under present procedures are companies able to engage in meaningful competition in preparing their proposals?
- Is sufficient information available for companies to predict the actions of their competitors and the requirements of the customer?

If fallacious assumptions are held concerning competitors and the customer, companies will be unable to effectively adjust their proposals to meet their competition. The benefits of competitive procurements may be significantly negated by inadequate perceptions of the market and proposals may constitute only blindmen's efforts to hit a moving target.

The Nature of the Study

To examine some of these questions two studies were undertaken; one of the bid decision, a second of the proposal preparation process within companies. For the bid decision one competition from each of two government agencies was studied. They were each for contracts in excess of \$500,000 but less than \$1,000,000 . Forty-eight of the 76 companies which were solicited participated in the study. A questionnaire was sent to each within a week after the government had issued its request for proposal. In the questionnaire companies were asked about the factors which they considered in making their decision to bid.

For studying the preparation of the proposals four more competitions in addition to the two above were investigated. For these six competitions 21 of the 26 companies submitting proposals agreed to participate in the study. The size of the contracts in these competitions varied from \$100,000 to \$3,500,000 . The size of the companies in both studies ranged from the largest aerospace companies to the smallest scientific companies. Contracts were all single step fixed price or incentive procurements. They varied with respect to the type of research which they encompassed. One was primarily a study contract of some aspects of satellite communication. Another was primarily a development contract for testing certain vehicle aerodynamic characteristics.

Each of these companies was visited prior to the announcement of the award of the contract and therefore was unaware of how their proposals would fare in the competition. Interviews were conducted with the technical proposal manager with the aid of a structured questionnaire. Subsequent to the announcement of the contract award, the results of the government evaluation were obtained. Rankings of each company according to technical quality, cost, and overall merit were obtained. All participants in the study, both government and company were guaranteed anonymity.

The Bid Decision

The study revealed that perhaps not all of the highly qualified companies submit bids. There were 8 non-bidding companies which felt that if they had submitted a proposal it would have been either superior technically or lower in cost than that of the anticipated competition.

The distinguishing characteristic of this group was their feeling that the customer considered them to have only an outside chance in the competition, whereas the bidders felt that they were considered by the customer to be one of the strongest competitors. This evidence suggests that,

1. either intentionally or inadvertantly the government is leading these presumably qualified companies to believe that the winning company has been preselected or
2. companies have been led to believe that the subjective and personal preferences of the customer are more important in the determination of the winning company than is the factual content of their proposals.

In either case it is the customer's presumed selection bias and not the merits of their proposals which is most strongly affecting their decision not to bid. The government can only benefit from the elimination of such misconceptions and the encouragement of proposals from these companies.

To what extent does the proposal process discourage poor quality proposals? Of the 26 companies which submitted bids in these competitions over 40% were found by the government to be technically unacceptable. This is an extremely high percentage for it means that 40% of those proposals which are submitted and paid for are not worthy of consideration nor capable of enhancing the level of competition.

Why is it then that more of these poor quality proposals are not discouraged. Some answers appear when we examine the factors which companies said they considered in deciding whether or not to bid. Table 1

shows a breakdown of these factors according to whether they are customer related, competitor related, or related to the internal considerations of the company reflecting its commitment of objectives and resources to a particular technical area.

TABLE 1

Percentage of Time Factors Concerned with
the Customer, Competitor, and Internal Company
Interests are Used in the Decision to Bid

Customer Related Factors	Competitor Related Factors	Internal Company Related Factors
28 %	24 %	48 %

Internal factors appear to outweigh the other two categories in making the bid decision. A much lesser part of this decision is based on evaluations of competitors or of the customer.

To explore further the importance of competitive factors, companies were asked to name those companies which they expected to submit proposals. On the average companies named 3 competitors. Of those companies named 20% were never solicited. Only 35% of the companies named even submitted a bid. Only 34% of the non-winning and no-bidding companies even named the winner as a principal competitor. Faced with this inability to identify competitors it is not surprising that companies have reverted primarily to internal commitment as the basis for their bid decisions. The information which is available about competitors seems quite inadequate for assessing one's relative capability within a particular competition.

Thus in evaluating the elicitation of bids we have found that:

1. many qualified companies, 10 - 15 % of the total number solicited, do not bid for reasons which are unrelated to the quality of the proposals which they might submit, and
2. that many unqualified companies do bid, perhaps because of inadequate information with which to evaluate their competitive strength.

Proposal Preparation

The thrust of this portion of the discussion is to determine if companies which decide to bid have sufficient information about their competitors to incorporate competitive considerations into the preparation of their proposals. If these considerations are not possible, the data may bring into focus the nature of the distortion of these considerations from true economic behavior.

Level of Information

The companies which decided to bid were found to be just as ignorant of the identity of their competitors as the sample of bidders and non-bidders cited earlier. Only 45% of the companies named as competitors submitted a bid and only 25% of the non-winning companies named the winner as a competitor. Further, for the competitors which they did identify, they were unable to give with any assurance or accuracy the technical approaches of their potential competitors or the prices which they might offer.

Although unaware of the specific technical approaches and prices of their competitors it is possible that companies may know the relative technical quality and prices of their proposals with respect to those of their competitors. To assess this possibility companies were asked to state whether they thought their proposal would be technically

superior to

equal to.

inferior to

each of their competitors' proposals and whether they expected their price to be

higher than

equal to

lower than

that of each of their competitors. Forty-four percent of the technical comparisons were incorrect as judged by the government evaluation teams. Fifty-seven percent of the cost comparisons were incorrect. Thus, in neither case was the accuracy any better than could be achieved by a random guess.

Finally companies were asked if they even considered the competition in the preparation of their proposals. Less than half said that they considered any particular competitors (see Table 2). Just as in the

TABLE 2

Degree to which Companies Explicitly Considered
Other Competitors in the Preparation of Their Proposals

Considered one company in particular	Considered several companies in particular	Considered the competition in general
19 %	29 %	52 %

bid decision it would appear that companies are forced to diminish their consideration of competitive factors in the preparation of their proposals due to lack of information.

Market Misconceptions

In light of this ignorance of the competition we are led to wonder if some erroneous perceptions have developed in the minds of those who prepare proposals. Three such perceptions were found. First companies appeared to consistently overestimate the magnitude of their competition. On the average they expected 6.5 companies to bid, whereas only about 4 companies bid in each competition. The significance of this overestimation is further dramatized by Table 3 in which the percent of companies which overestimated the number of competitors far exceeds the total of those which correctly estimated or underestimated this figure.

TABLE 3

Distribution of the Accuracy of Company Estimates
of the Number of Companies Submitting Proposals

	Overestimated	Correctly Estimated	Underestimated
Number of Companies Which	67 %	11 %	22 %

In the second misconception companies generally felt that the prices of their competitors' proposals were optimistic. However, if this level of optimism perceived by companies in competitors' proposals is compared

with the optimism which these competitors themselves perceive in their own proposals, a clear bias is revealed in companies' perceptions of their competitors. A competitor's proposal is generally perceived as higher in risk than the competitor himself perceives his own proposal (see Tables 4 & 5).

TABLE 4

Company Perceptions of the Cost
Optimism of Their Own Proposals

	Optimistic	Neither Optimistic Nor Conservative	Conservative
Percentage of Companies Which Thought Their Proposals Were	28 %	34 %	38 %

TABLE 5

Company Perceptions of the
Cost Optimism of Their Competitors' Proposals

	Optimistic	Neither Optimistic Nor Conservative	Conservative
Percentage of Times Companies Expected Their Competitors' Proposals to be	63 %	32 %	5 %

In this study it was assumed that companies were better estimators of the risk in the price of their own proposals than were their competitors.

Finally companies overwhelmingly believed that they were superior technically to their competitors (see Table 6). Clearly this is an

TABLE 6

Distribution of the Expectations by
Companies of the Technical Design Quality of Their Proposals
Relative to Those of Their Competitors.

Percentage of Time Companies Expected to be			
	Better than their competitors	As Good as their competitors	Poorer than their competitors
Technical Design	72 %	23 %	5 %

impossibility since there must be an equal distribution of companies falling into each of the three indicated categories. The combination of the latter two biases of competitive price optimism and technical superiority may well lead to a rather erratic perception of the proposal evaluation process. Competitions may be perceived as being won on the basis of technical quality and lost on the basis of price. If this is the case then losing companies will be encouraged in later competitions with similar technical requirements to make no changes in their technical approach but to submit a lower price. The contrary strategy, however, of modifying the technical approach may be more advantageous for the company and the government in light of the large percentage of technically unacceptable proposals which have been found to be characteristic of

these competitions.

Some Considerations for Improvement

It is not enough to say that competition in itself leads to efficiency in procurement. There are many dimensions of competition which affect the quality of the proposals received and the level of the funds expended for solicitation. What alternative approaches might be considered for improvement of the quality of this solicitation process?

The government might provide greater feedback about the relative quality of each proposal at the conclusion of each competition. This might serve to correct some of the misconceptions which influence the preparation of proposals and enable companies to better evaluate the quality of their technical approaches for the purposes of reinvestment and resubmission in other competitions. The nature of this feedback is critical to the feasibility of the approach. It is often quite difficult for a contracting agency to advise a company on the relative technical weaknesses of its proposal because it is constrained from advising the company of the technical characteristics of the other proposals. Since a company's proposal is only weak in comparison to the other alternatives which are offered, the contracting agency is faced with having to advise the company of technically weak areas without being able to offer justification. This leads to strained relations and perhaps disbelief on the part of the company. These legitimate proprietary constraints therefore lead us to consider alternative modes of feedback.

One approach is to tell companies how they were ranked on the principal dimensions of evaluation such as technical quality, management, and price. Further they might be told if their proposal was judged technically acceptable or unacceptable. Each company might be told the company identity, ranks, and price of each of the other proposals in the competition. Price is a particularly important dimension because it reveals so much about the extent of a proposal and because there is such a large variance in price within each competition. In this study, for example, the average absolute difference between the price of the winning proposal and the price of the non-winning proposals, as a percentage of the latter, was 48%. It might also be possible to select particular dimensions of performance and indicate the expected level of attainment for each proposal. An example of how these suggested types of feedback might be presented to companies is shown in Figure 1.

None of the aspects of this feedback violate proprietary rights and yet they provide an order of magnitude greater information beyond what is yielded by the mere announcement of the winner. With this information companies should be able to make much more rapid evaluations of their technical capabilities in their fields of interest. These more rapid and more accurate technical assessments should greatly improve the efficiency of their technical investment and bid decisions.

As a second approach the government might advise all those companies which are solicited, particularly losers and no-bidders, of the identity of those companies which ultimately bid and of the company which wins. This may provide companies with a much greater basis of knowledge for anticipating their competitors on future competitions. It also may serve

FIGURE 1

Example of Information to be Provided to All Competing
Companies at the Conclusion of Each Competition

COMPETITION: Dash Time

WINNER: Boise Motors

PRICES

Adams Aircraft	\$ 7,900,000
Boise Motors	5,000,000
Consolidated Engines	6,700,000

TECHNICAL RANKS

Boise Motors	1	
Consolidated Engines	2	
Adams Aircraft	3	--- Technically Unacceptable

MANAGEMENT RANKS

Consolidated Engines	1
Boise Motors	2
Adams Aircraft	3

MAXIMUM DASH SPEED WITH THE TECHNICAL APPROACH DEVELOPED BY

Adams Aircraft	2000	mph
Boise Motors	2500	mph
Consolidated Engines	2700	mph

to reduce their estimates of the number of competitors since they will receive a continuous flow of accurate information from which they can correct their previously biased estimates and perceptions.

A third approach might be to allow, to a much greater extent than currently exists, prospective bidders to contact the government technical personnel after the ^{request for} proposal has been issued. In the past this has been prohibited, except in the case of bidders conferences, because of the feeling that undue advantage might be gained by one company over another through the acquisition of special knowledge for their proposal. However, it seems more likely that the penalties associated with this particular rule are more detrimental than the probable gains. First it is clear that because of contacts prior to the issuance of the request for proposal, some companies have already established an advantage. The prohibition of contact after the issuance of the request for proposal tends to freeze these companies in a more advantageous position rather than equalizing everyone's competitive basis. This rule does not therefore serve the purpose for which it was intended to assure equal footing for all.

If the restraint on contact is removed, those companies which feel themselves highly qualified but choose not to bid because of their perception of the customer's preference for other companies, might be able to make contact and establish whether their approach has sufficient merit to warrant a proposal.

In summary I have tried to show that the cost effectiveness of the government's proposal solicitation process is directly related to the effectiveness of the bid and proposal preparation decisions which companies make. Several measures of solicitation effectiveness were examined and some weaknesses in the process explored. While this discussion is more directly applicable to smaller single step procurements, the findings

raise questions and suggest several considerations which may have direct significance for larger multiphase competitions.

The principal conclusion which it is hoped the reader will be left with is that losers of competitions must be given greater feedback at the conclusion of each competition. The decisions which they make in adjusting to the loss through the selection of new competitions to enter and pursuit of new and previous technical fields of endeavor are just as important to the government as the activities of the winner in the execution of the contract.

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